No. 832,195. PATENTED OCT. 2, 1906.

W. K. HOWE.

RAILWAY SIGNALING APPARATUS.

APPLICATION FILED JULY 20, 1903. RENEWED MAY 17, 1906.

4 SHEETS—SHEET 1.

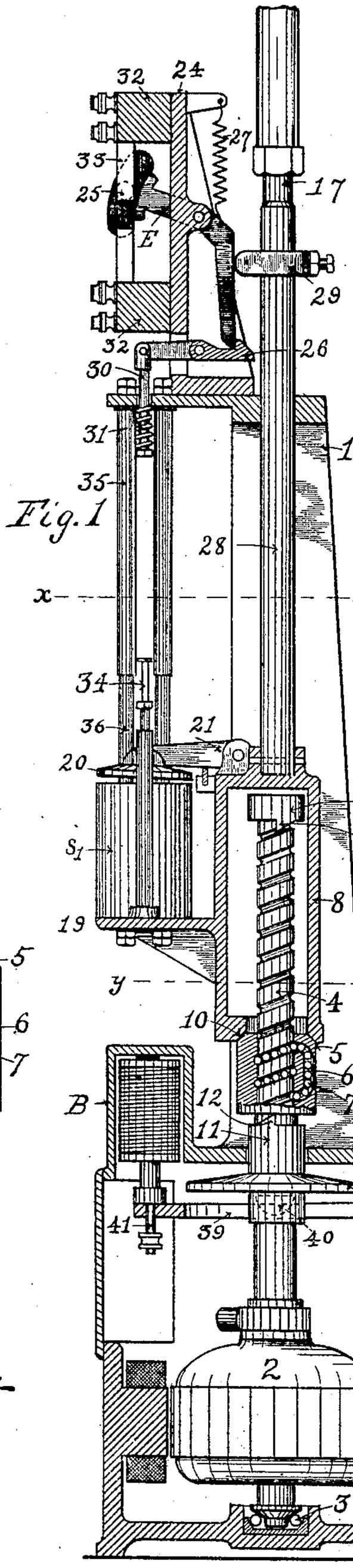

Fig. 1

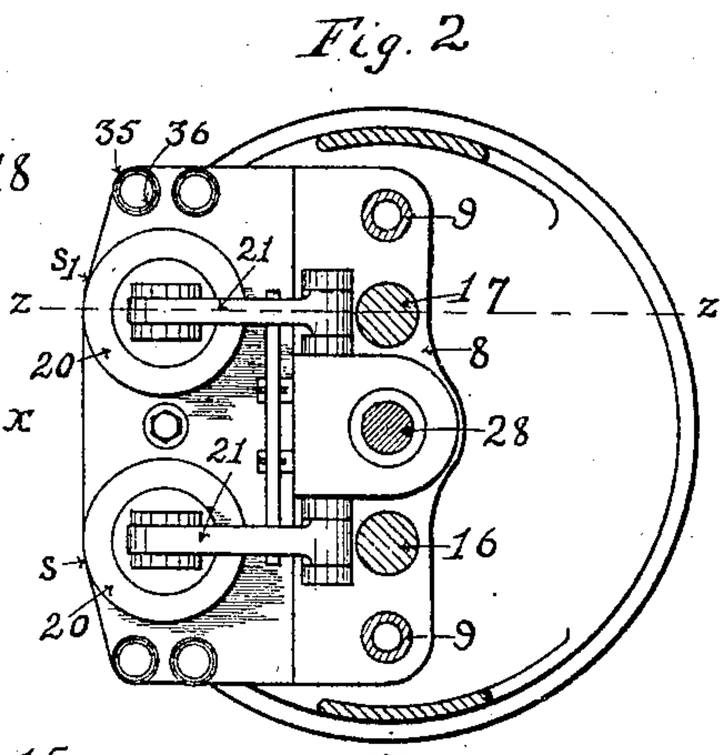

Fig. 2

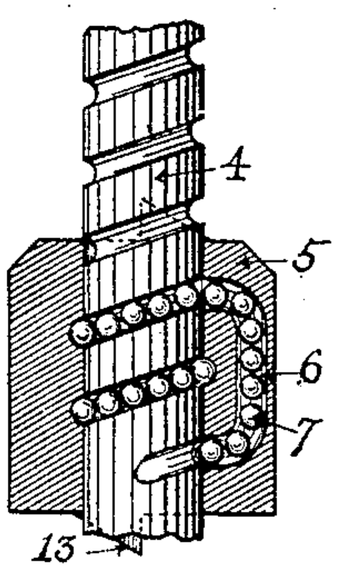

Fig. 4

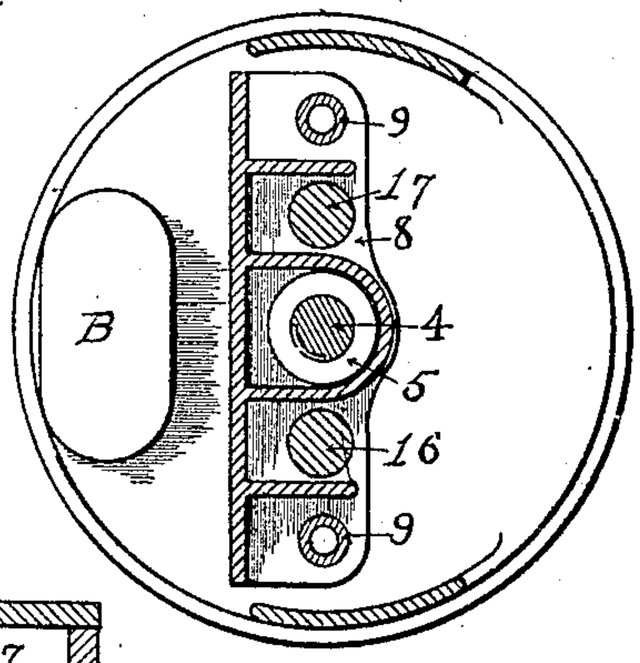

Fig. 3

Witnesses:
S. Brown
Geo. H. Hager

Inventor:
Winthrop K. Howe,
by his Attorneys,
Macomber & Ellis

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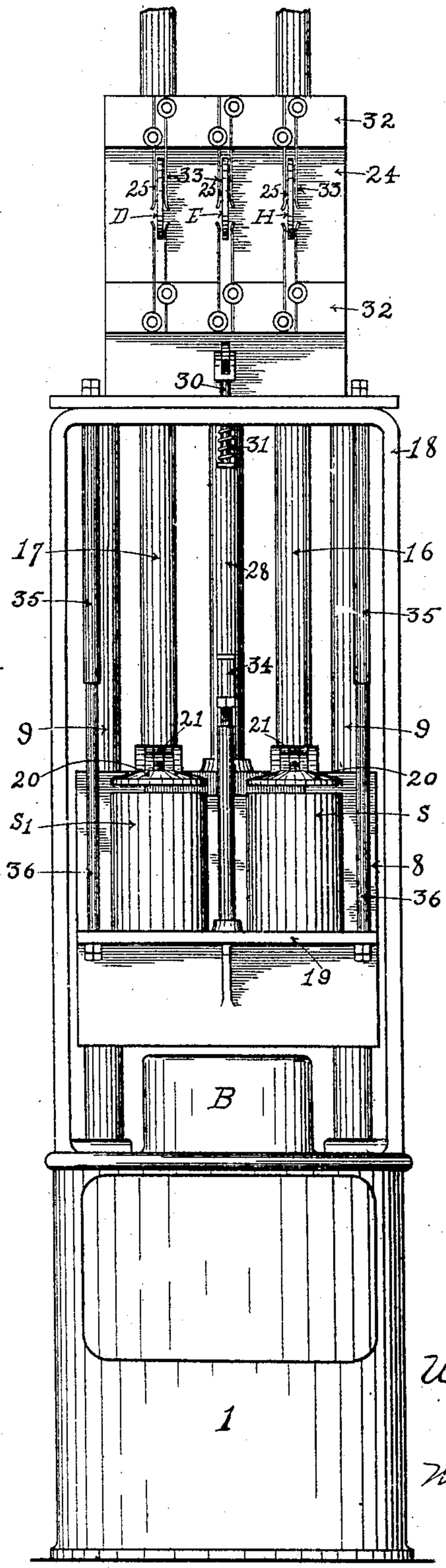
Fig. 5



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4 SHEETS—SHEET 3.

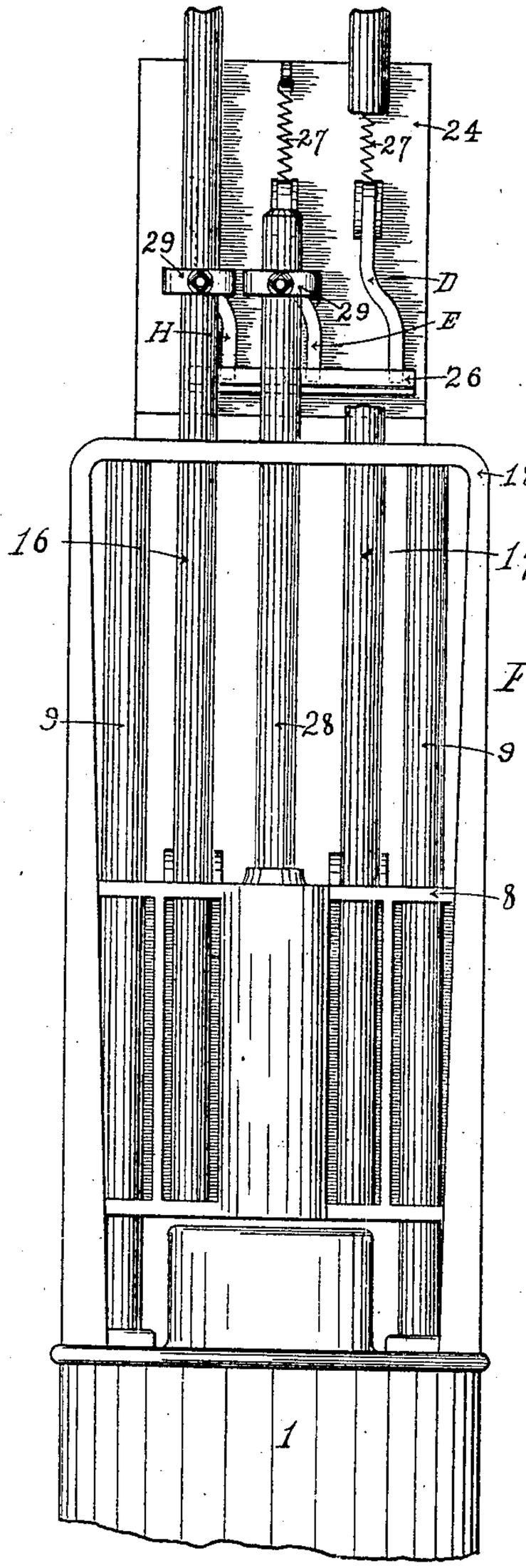

Fig. 6

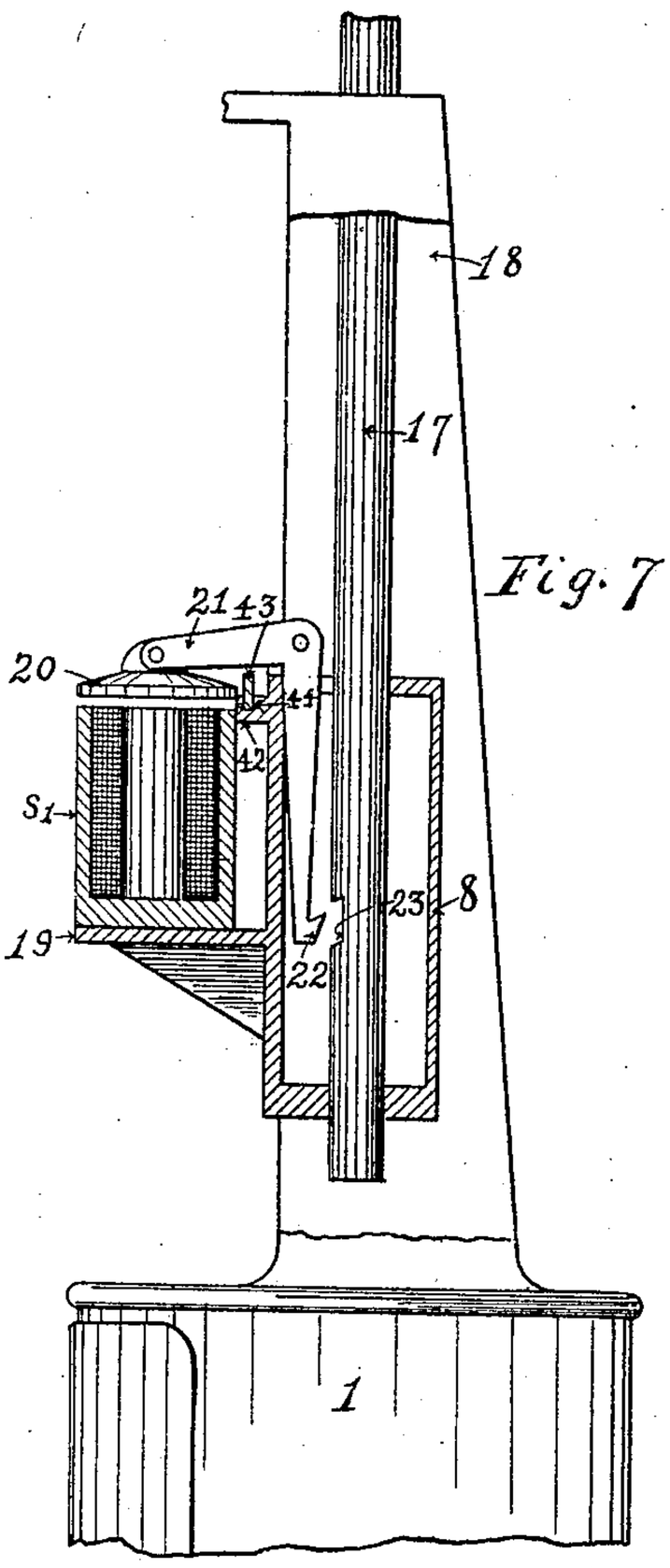

Fig. 7

Witnesses:
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APPLICATION FILED JULY 20, 1903. RENEWED MAY 17, 1906.

4 SHEETS—SHEET 4.

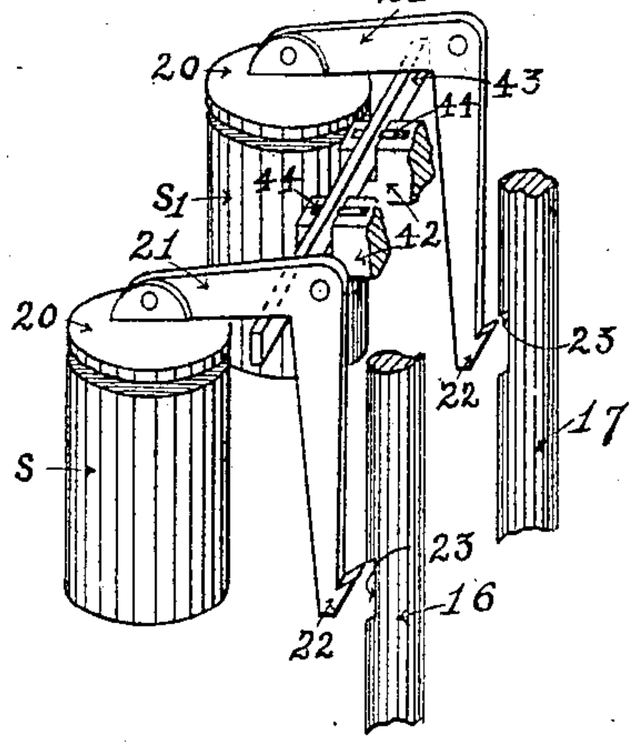

Fig. 8

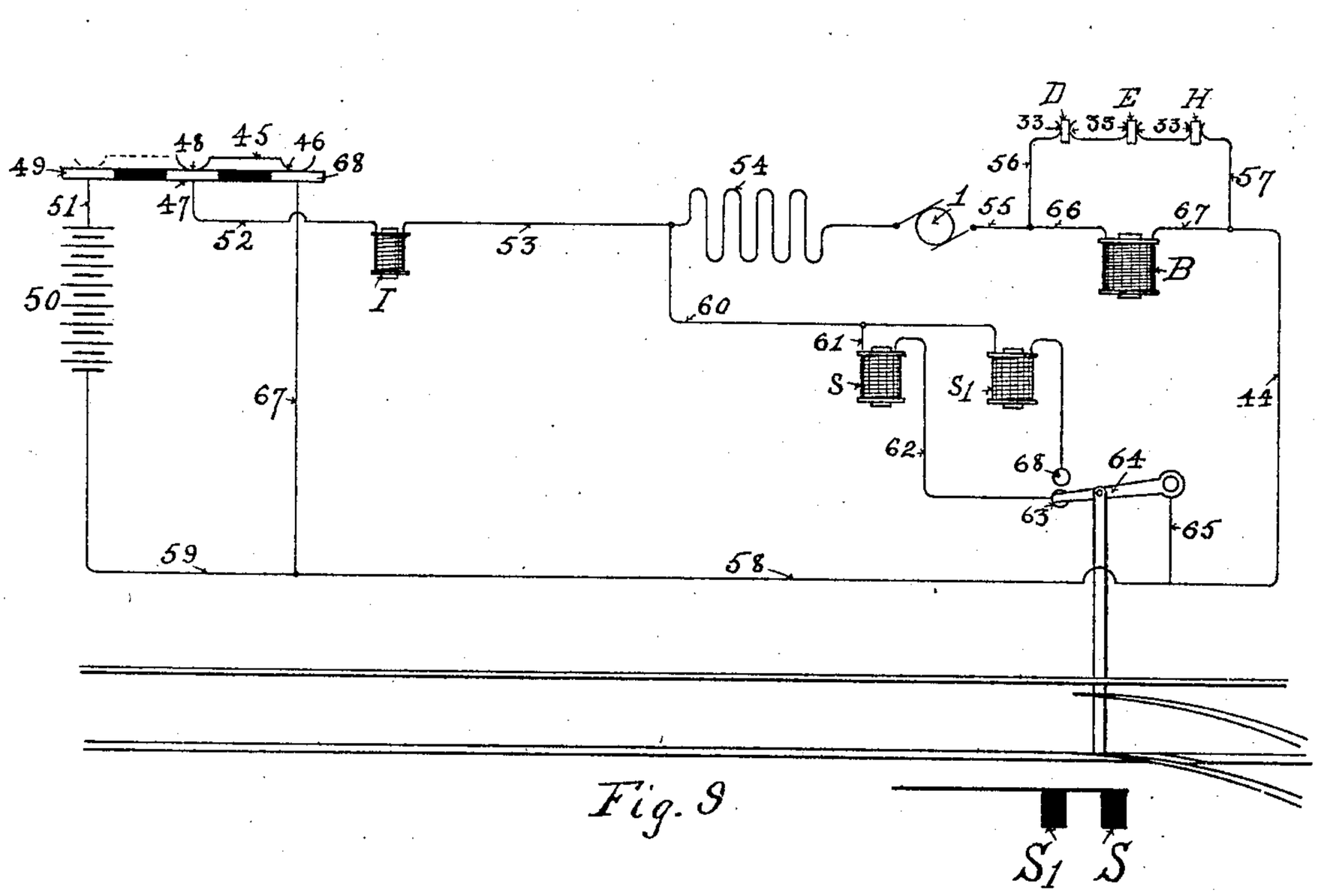

Fig. 9

Witnesses:
S. Brown
Geo. L. Hager

Inventor:
Winthrop K. Howe,
by his Attorneys,
Macomber & Ellis

UNITED STATES PATENT OFFICE.

WINTHROP K. HOWE, OF BUFFALO, NEW YORK, ASSIGNOR, BY MESNE ASSIGNMENTS, TO GENERAL RAILWAY SIGNAL COMPANY, OF BUFFALO, NEW YORK, A CORPORATION OF NEW YORK.

RAILWAY SIGNALING APPARATUS.

No. 832,195. Specification of Letters Patent. Patented Oct. 2, 1906.

Application filed July 20, 1903. Renewed May 17, 1906. Serial No. 317,344.

To all whom it may concern:

Be it known that I, WINTHROP K. HOWE, a citizen of the United States, residing at Buffalo, New York, have invented certain new and useful Improvements in Railway Signaling Apparatus, of which the following is a full, clear, and exact description.

My invention relates to railway signaling apparatus, and more particularly to mechanism for operating signals and mechanism governing the mechanism so operating the signals.

My invention, furthermore, relates to that class of railway-signals which are operated by electricity as the motive power and in which indication of the movement of the signal is communicated electrically.

My invention has for its object the construction of mechanism which will readily and effectively operate a signal, particularly of the semaphore type and which is capable of being incased in the signal post or column in a compact and convenient manner and which is not affected by weather conditions, and has for its further object the prevention of a false movement or a false indication due to a cross where more than one signal is operated by the same mechanism.

My invention is applicable either to that class of signals wherein one or the other of two signals is operated according to the position of the electric switch governed by a track-switch, which electric switch closes in circuit one or the other of two selector-magnets, or to that class of signals wherein one of two or more signals is operated by means of selector-magnets governed through electrical connection by the operator. Since the adaptation of my invention to signals of the latter class is a mere matter of mechanical construction and equipment of circuits which are well known, for simplicity of description I shall confine my drawings and specification to an apparatus employing the ordinary signals which are governed by an electric switch governed by a track-switch. It will, furthermore, be recognized that this invention is particularly adaptable to and to be used in conjunction with the inventions disclosed by and patented to John D. Taylor, No. 554,097, Reissue No. 11,983, and No. 717,080, the latter patent disclosing the selector device under control of the operator, above referred to.

Referring to the drawings herewith, in which like characters of reference indicate corresponding parts, Figure 1 is a vertical central section of my invention. Fig. 2 is a horizontal section on the line x x of Fig. 1. Fig. 3 is a similar section on the line y y of Fig. 1. Fig. 4 is an enlarged detail section of the ball-bearing screw shown in Fig. 1. Fig. 5 is an elevation looking from the left in Fig. 1. Fig. 6 is an elevation looking from the right in Fig. 1. Fig. 7 is a vertical section on the line z z of Fig. 2. Fig. 8 is an enlarged detail in perspective of the controlling mechanism hereinafter referred to. Fig. 9 is a diagram of the circuits.

I will first indicate the principal parts of the mechanism and will, secondly, describe their operation in connection with the circuits shown in the diagram of Fig. 9.

Referring particularly to Figs. 1 and 4, in the first place it will be understood that the mechanism herein shown and described is all contained within a cylindrical casing constituting a signal-post. (Not shown in the drawings.) 1 is a base within which is mounted vertically the armature of a motor 2. This base is cylindrical and preferably carries integral with it the pole-pieces of the motor, upon which the field-windings are placed. The lower end of the motor-shaft is preferably supported in an antifriction-bearing, as shown at 3. The upper end of the motor-shaft is directly coupled to a screw 4, which has a suitable thread cut into it of a steep pitch. Mounted upon the screw 4 is a nut 5, which is internally threaded to correspond to the threading of the screw 4, and which nut is provided with a return-channel 6, as clearly shown at Fig. 4, which returns the balls 7, constituting an ordinary ball-bearing screw. Since this ball-bearing screw is of a well-known construction, further description thereof is unnecessary. 8 is a cage which is free to move vertically within a limited distance upon the guide-rods 9 clearly shown in Figs. 5 and 6. The nut 5 is preferably conical at its upper end and fits into a conical seat in the lower end of cage 8, as shown at 10 in Fig. 1. The nut 5 is free to rotate with the screw 4, except as it is held

frictionally in contact with the cage 8 by this conical bearing just above described. Mounted rigidly upon the shank of the screw 4 is a sleeve 11, which has a dog 12, and upon the lower face of the nut 5 is a similar dog 13, (shown in Fig. 4,) which is capable of engagement with the dog 12 on the sleeve 11. Upon the upper surface of the nut 5 is a similar dog, which is capable of engagement with the dog 14 on a sleeve 15, which is rigidly secured to the upper end of the screw 4. It will now be seen that if the motor 2 is rotated in the direction to screw the nut upward, owing to the inferior friction of the ball-bearing screw to the much greater friction of the conical bearing at 10 between the nut 5 and the cage 8 the nut will not revolve, but the nut and the cage will both be carried upward until the dog on the upper end of the nut 5 comes into engagement with the dog 14 on the screw 15, locking the nut and screw together, whereupon further rotation of the armature will cause both nut and screw to revolve and stop the upward motion of the cage 8. In the reverse movement the nut will not revolve until it reaches the point where the dog 12 engages the dog 13, whereupon further downward movement of the cage 8 will be arrested and both screw and nut will revolve with the motor. The object of employing an antifriction screw and nut will now be evident. In the first place since it is necessary to have the fall of the signal cause rotation of the motor acting as a generator to produce the current necessary to indication a screw of very steep pitch is essential, and a screw and nut of the ordinary type presents so much friction that a prohibitive amount of power is required. Hence the necessity of an antifriction-screw. In the second place, with an ordinary screw and nut the upward movement is stopped by the thrust of the signal-shaft overcoming the energy of the motor. This causes rack and strain on the signal. On the downward movement the strain of stopping the motor comes on the screw and connecting mechanism. Hence the necessity of a nut set in a friction-bearing and means for causing united rotation of nut and screw at the end of a movement.

Referring now especially to Figs. 5, 6, and 7, 16 and 17 are shafts which are at their upper ends pivotally connected to the signal-arm, so that their upward axial movement will move their respective signals to one position, while the gravity action of their respective signals will carry them backward to their initial position. These shafts 16 and 17 for purposes of further description I designate as connected to the signals S and S′. (Shown on diagram of Fig. 9.) These shafts are free to move upward through bearings in the yoke 18, which is rigidly secured to the base 1, and are free to move axially within bearings in the cage 8. Upon the cage 8 is a bracket 19, upon which are mounted the magnets *s* and *s*′. Suspended over these magnets are disk-shaped armatures 20, which are pivotally secured to bell-crank levers 21, which are pivoted at their elbow-point to a lug upon the cage 8. The other ends of these levers 21 terminate in hooks 22, which are capable of engagement in slots 23 cut into the sides of the shafts 16 and 17. If now, for example, the magnet *s* is energized, the armature 20 will be drawn downward, and the hooked end 22 of the bell-crank lever 21 will be thrown into engagement with the slot 23 on the shaft 16, and if then the motor be energized so that the cage 8 is raised, the hook 22 being in lock with the shaft 16, the shaft 16 will be carried upward with the cage and will thus raise its signal S. Mounted upon the yoke 18 is a vertical bracket 24, as clearly shown in Figs. 1, 5, and 6. Mounted through this bracket 24 upon pivots are arms D, E, and H. These arms at their upper and outer ends carry insulated contacts 25. Pivotally mounted upon the bracket 24 is a latch 26. This latch 26 is capable of engaging with one or two or all three of the lower arms of the levers D, E, and H and extends transversally a sufficient length to so engage the points of all of said levers, as is clearly shown in Fig. 6. Secured to the arms of the levers 25 are springs 27, which are at their other end secured to lugs on the bracket 24, which tend to throw the lower and vertical arms of the levers D, E, and H outward and to throw the upper and outer arms downward. The upper end of the cage 8 carries a shaft 28, which is rigidly keyed to it and which lies in vertical plane with the shafts 16 and 17. The shafts 16, 17, and 28 have adjustably mounted upon them lugs 29, which are capable of engagement against the outer faces of the arms D, E, and H, respectively. The outer end of the latch 26 is pivoted to a stud 30, which passes upward through a hole in the horizontal portion of the yoke 18 and carries a spring 31, which tends to carry the stud downwardly, and consequently throw the latch 26 upwardly. Mounted upon insulating-blocks 32, secured to the bracket 24, are contact-plates 33, which are capable of making contact with the contact-pieces 25, secured to the arms D, E, and H. Mounted upon the bracket upon the cage 8 is an adjustable rod 34 in axial alinement with the stud 30. It will now be seen that when the cage 8 is in its lowest position the lugs 29 will engage the faces of the arms D, E, and H and throw the contacts 25 into electrical connection with the contacts 33 and will press the lower ends of these arms against the latch 26 and into engagement with the latch 26, and thus engaged the latch 26 will hold the arms D, E, and H from responding to the action of the springs 27 until the rod 34 is carried upward

by the cage 8 and brought into engagement with the stud 30, thus rocking the latch 26 on its pivot and freeing D and E or E and H, and the rod 34 is so adjusted that the action of freeing D and E or E and H, and thus breaking their electrical connections through the contacts 25 and 33, will not occur until the signal has completed its movement to the clear position. In order to establish perfect electrical connection between the wires and the magnets *s* and *s'*, which are moved up and down with the cage 8, I provide the telescoping tubes 35 and 36, the tubes 35 being secured to and insulated from the yoke 18 and the tubes 36 being secured to and insulated from the bracket 19. The electrical connection between these moving and stationary parts may be further insured, if it is so desired, by inclosing within these telescoping tubes 35 and 36 a helical coil of an electrical conductor.

Referring to Fig. 1, mounted upon the armature-shaft is a brake-disk 37, and pivoted to the base 1 by a lug 39' is a yoke 39, which carries brake-shoes 40, capable of frictional contact with the under surface of the disk 37. At the outer end of the yoke 39 is a rod 41 with an adjusting-nut, and said rod 41 is directly connected to the sliding core of a brake-magnet B, mounted in the base 1.

Referring now especially to Figs. 7 and 8, secured to the cage 8 are brackets 42, which are transversally slotted to carry a bar 43 and which are mortised upon their upper surfaces to receive and seat the pins 44, which are rigidly secured to the bar 43. The brackets 42 and the bar 43 are so positioned that the bar 43 lies underneath and in contact with the under sides of the upper portion of the arms 21 and holds the armatures 20 a short distance from the magnets *s* and *s'*, and the bar 43 is furthermore so positioned that it is free to rock upon the pins 44 to permit one or the other of the arms 21 to make its full stroke and so positioned that if both magnets *s* and *s'* should be energized, at the same time tending to carry down both levers 21, the bar 43 would arrest the movement of both levers and prevent either from engaging with the shaft 16 or with the shaft 17. I employ the two blocks 42 and the two pins 44 instead of the single block for this reason. In the event of a cross the current might pass through the coils of both magnets *s* and *s'*, and yet not be of the same strength, owing to resistance in the cross, and if there were only one pivot 44 the one magnet might overcome the other and cause the engagement of one hook or the other, whereas with the two pivots the difference in leverage is such that it would be impossible for the slight superiority of one magnet over the other to overcome its mate to complete the stroke.

With this general description of the mechanism employed I will now describe a single operation by reference to the diagram of Fig. 9, as the operation of a second, third, or fourth signal would be substantially a repetition of the operation which I will describe. Assuming the mechanism to be in the position shown in the figures and that it is desired to clear the signal S, the operator moves the contact-bar 45 so that the contact 46 makes electrical connection with the contact 47 and the contact 48 makes electrical connection with the contact 49, as shown in dotted outline in the drawings. This closes the circuit of the battery 50, so that the current flows through wire 51, contacts 49 and 48, bar 45, contacts 46 and 47, wire 52, magnet I, wire 53, field-coils 54, motor-armature 1, wires 55 56, contacts D, E, and H and their contacts 33 and connecting wires, wires 57, 44, 58, and 59, back to battery 50. At the same time a portion of the current is diverted and flows through wire 51, contacts 49 48, bar 45, contacts 46 44, wire 52, magnet I, wires 53, 60, and 61, magnet *s*, wire 62, contact 63, arm 64, wires 65, 58, and 59, back to battery 50. This latter circuit energizes the magnet *s* and causes it to throw its clutch 21 into engagement with its shaft 17, so that the signal S can be moved, and immediately the circuit first described energizes the motor 1, causing it to rotate in the direction calculated to carry the cage 8 upwardly. As the cage 8 rises the lugs 29 on the shafts 16 and 28 will be carried upwardly and out of contact with the arms D and E, leaving the arms D and E free to respond to the action of their respective springs 27. As soon as the signal has completed its movement rod 34 will strike the lug 30 and throw the contact 26 out of contact with D and E and allow them to respond to their springs and break the electrical connections through the contacts 25 and 33 through D and E. This will result in shunting the circuit first above described from the wires 56, contacts D, E, and H, and wires 57 through the wires 66, magnet B, and wire 67. This will energize the magnet B, causing it to raise the armature, raising the yoke 39 and bringing the brake-shoes 40 into contact with the under side of the disk 37, thus holding the motor from turning in the reverse direction, which it would tend to do by reason of the pressure communicated through the ball-bearing screw. Thus the current from the battery 50 will continue to flow through the magnet B as long as the signal is held at "danger." It will be noted that the circuit just described includes the indicating-magnet I. Since no indication is required when the signal is going to reverse, the energizing of this magnet performs no function at this time. The said magnet performs its proper function when energized by the current generated, as hereinafter described. It may be stated by way of explanation that it is customary

in the construction of signal apparatus of this class at the present time to pass the current actuating the magnet of the signal through the indicating-magnets. This will be found to be the form of construction employed in all of what are known as the "Taylor-system" signals. When the bar 45 has returned to its initial position, so that contact 46 makes electrical connection with contact 68 and contact 48 makes electrical connection with contact 47, the battery 50 will be cut out and the magnet B will be deënergized. The armature 1 will then be free to respond to the pressure of the screw, tending to rotate it in the opposite direction. When the cage 8 has nearly completed its downward movement, the lugs 29 will replace the contacts 25 of D and E, so that current generated by the rotation of the armature 1 will flow from the motor-armature through wires 55 and 56, contacts D, E, and H, wires 57 44 58 67, contacts 68 and 46, bar 45, contacts 48 and 47, wire 52, indication-magnet I, wire 53, field-coils 54, back to motor-armature 1. This will cause the magnet I to give the indication that the signal is again to "danger," and the parts will have been returned to the position shown in the drawings. It will be readily seen that if the rail-switch were in the reverse position, so that the arm 64 were put in contact with the contact-piece 68 instead of the contact-piece 63, the magnet s' would be energized and through it the signal S' would be operated. If through accident there should be a cross of the wires, so that the operating-current would flow through both magnets s and s', instead of only the magnet s being energized through the circuit above indicated, both magnets would be energized and both arms 21 would be attempted to be drawn downward, whereupon both arms would be held by the bar 43 and would be prevented from making their movement. It will thus be seen that if in the initial movement from normal to reverse there should be a cross preventing either signal from going to "safety," no dangerous condition could arise whether the operator knew of the cross or not. The most that could happen would be the failure to give a train its signal when it was entitled to it, and the operator would be readily informed of the failure by observation or by the engineer of the train whistling for right of way. Since some time might elapse after the event of such a cross and failure of any signal going to "safety" before the operator discovered such fact, it is necessary to provide means for stopping the motor at the completion of the upward movement of the cage 8 and also to provide means for producing the indication when the operating-bar is put back and the cage 8 descends to normal position. For these purposes the shaft 28 and the arm E are employed, since it is evident that if neither shaft 16 nor 17 were moved the circuit would not be shunted through the magnet B by D or H. The cage 8 will be carried upward even if there is a cross sending current through both s and s', and the contact E will be thrown out at the completion of the upward movement and the lug 29 on the shaft 28 will throw it in near the completion of the return to normal, thus closing the indication-circuit to permit of the regular indication.

Having thus described my invention, what I claim is—

1. In an electric railway-signal in combination with a source of energy and a visual signal or signals, a motor, an antifriction-screw rotated by said motor, an antifriction-nut actuated by said screw, and means for communicating the movement of said nut to said signal or signals, substantially as and for the purposes set forth.

2. In combination with a source of electric energy and a visual signal, a motor vertically mounted, an antifriction-screw in rotation with the shaft of said motor, a nut actuated by said screw, means for moving said visual signal, a cage, means for engaging said cage with said means for moving said signal, a frictional contact between said cage and said nut, and means for limiting the motion of said nut on said screw, and causing the same to rotate upon said friction-bearing, substantially as and for the purposes set forth.

3. In an electric railway-signal, in combination with a source of electric energy and a visual signal, a motor, an antifriction-screw, a nut, a cage in frictional contact with said nut on said screw, means for engaging said cage with the shaft on said signal and a brake for holding said screw against rotation during a predetermined period or periods, substantially as and for the purposes set forth.

4. In an electric railway-signal, in combination with a source of energy and a visual signal, an operating-circuit, an indication-circuit, a motor, an antifriction-screw in rotation with the shaft of said motor, a nut on said screw, a cage actuated by said nut, a brake, a brake-magnet for actuating said brake, a shunt-circuit to said main circuit including said brake-magnet, an electric switch actuated by said cage for cutting-in said shunt-circuit to actuate said brake, and means for replacing said electric switch upon the descent of the sigual, thereby closing the indication-circuit, substantially as and for the purposes set forth.

5. In an electric railway-signal, in combination with a source of energy and visual signals, an operating-circuit, an indication-circuit, a motor, an antifriction-screw in rotation with the shaft of said motor, a nut on said screw, a cage actuated by said nut, a selector-magnet, a circuit capable of closing

said magnet with said battery, a clutch actuated by said magnet for engaging the shaft of said signal with said cage, a brake, a brake-magnet for actuating said brake, a shunt-circuit to said main circuit including said brake-magnet, an electric switch actuated by said cage for cutting-in said shunt-circuit to actuate said brake, and means for replacing said electric switch upon the descent of the signal, thereby closing said indication-circuit, substantially as and for the purposes set forth.

6. In combination with a source of electric energy, and a plurality of visual signals, a motor, an antifriction-screw, a nut, a cage actuated by said nut, a selector-circuit, selector-magnets, a brake-magnet, an indication-magnet, operating and indication circuits, an electric switch for closing said operating and indication circuits, a shunt-circuit around said switch and including the brake-magnet, shafts for said visual signal, clutch mechanism actuated by said selector-magnets to engage the shaft of a signal with said cage, a brake actuated by said brake-magnet to hold the signal to safety, mechanism actuated by the movement of said cage to operate said electric switch to shunt the power-current through said brake-magnet, and means actuated by the descent of said shaft for closing the switch in the main circuit and permitting the indication-current to flow through said indication-magnet upon the reversal of the lever-bar, substantially as and for the purposes set forth.

7. In an electric railway-signal, in combination with a source of energy and a visual signal, an operating-circuit, an indication-circuit, and a shunt-circuit of a motor and a brake-magnet in said shunt-circuit for holding the signal at reverse, a screw in rotation therewith, a nut driven by said screw, a cage, a shaft connected with said signal, means for engaging said shaft with said cage and a brake actuated by said brake-magnet, substantially as and for the purposes set forth.

8. In an electric railway-signal, means for preventing an improper movement of the signals due to a cross, comprising, selector-magnets, shafts actuating said signals, clutches actuated by said magnets, a bar engaging under the arms of said clutches, lugs and pivots supporting said bar at two points, said lugs and said pivots being so positioned within the contact-points of said bar with said clutch-arms as to permit the descent of one or the other of said arms singly, but to prohibit the descent of both arms at the same time, thus preventing the engagement of both clutches at the same time, substantially as and for the purposes set forth.

9. In an electric railway-signal, in combination with a source of energy and a plurality of visual signals, an operating-circuit, an indication-circuit, a motor, an antifriction-screw in rotation with the shaft of said motor, a nut on said screw, a cage actuated by said nut, a brake, a brake-magnet for actuating said brake, a shunt-circuit to said main circuit including said brake-magnet, selector-magnets, selector-circuits and means for making and breaking said selector-circuits, shafts actuating said signals, clutches actuated by said selector-magnets to engage said shafts, an electric switch for opening and closing said operating and indication circuits, means for actuating said switch through the movement of any one of said shafts, and means for operating said switch through the movement of said cage independently of the action of any of said shafts, substantially as and for the purposes set forth.

In witness whereof I have hereunto set my hand in the presence of two witnesses.

WINTHROP K. HOWE.

Witnesses:

MYRON P. BUSH,

JOSEPH E. KEAN.